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# **Army Green and Sustainable Remediation: Policy and Implementation**



## **Environment, Energy & Sustainability Symposium and Exhibition (E2S2)**

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# Overview

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*A former DERP site, Fort Bragg promotes public access to the installation by providing a number of recreational opportunities, such as bird-watching, on its 18-mile All-American Trail, a registered North Carolina Birding Trail, located on remediated land.*

Photo: Elizabeth Evans, Fort Bragg

[www.army.mil/-images/2010/04/20/70522/](http://www.army.mil/-images/2010/04/20/70522/)



# OSD GSR Policy

- August 2009 Office of the Secretary of Defense (OSD) Policy Memo:
  - Consider and implement Green and Sustainable Remediation (GSR) practices “where and when they make sense” (August 10, 2009)
  - DoD Components requested to brief OSD on current efforts, strategies, and future plans

## **Green and Sustainable Remediation**

### **Minimize the overall environmental footprint through the following activities:**

- Evaluate sustainability during remedy selection
- Evaluate sustainability of existing remediation systems
- Preserve natural resources
- Minimize energy use and increase energy efficiency
- Minimize emissions
- Use passive sampling
- Minimize fresh water consumption and maximize water reuse
- Maximize recycling, reuse, and reduction of materials
- Consider use of environmental remediation technologies with inherently sustainable aspects



# Headquarters GSR Overview

- Army GSR Strategy:
  - Sustainability concepts addressed in the 2004 Army Strategy for the Environment
  - Green remediation specifically included in FY10-11 Army Environmental Cleanup Strategic Plan
- Ongoing efforts:
  - Participate and partner with other agencies
  - Conduct Pilot Projects
  - Optimize Existing Remedies
  - Utilize Sustainability Tools



*Colorado Gov. Bill Ritter Jr. and Maj. Gen. Mark A. Graham, commanding general, Division West, First Army and Fort Carson, prepare to cut the ribbon on the 15-acre Fort Carson solar array.*

Photo: Michael J. Pach

[www.army.mil/-images/2008/01/17/12170/](http://www.army.mil/-images/2008/01/17/12170/)

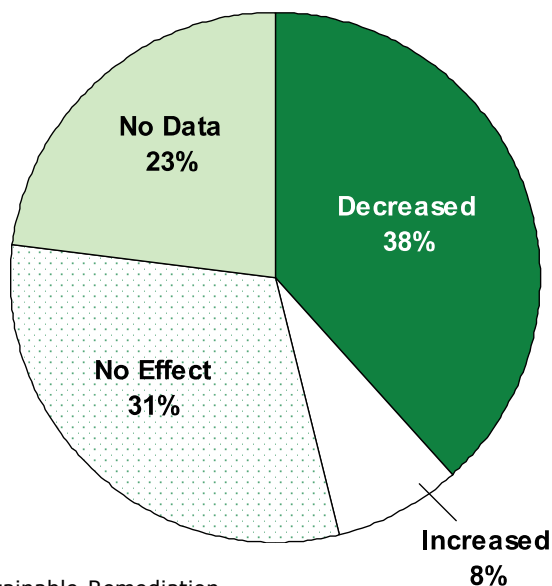




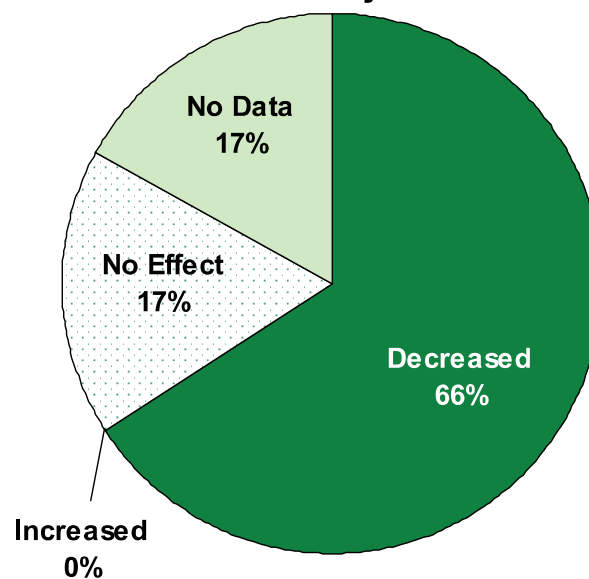
# GSR In Practice: Field Survey

- Army HQ developed a field survey to capture the broad nature and scope of Army GSR practices
- Initial scope: Tasked to all Army Commands (AEC, BRAC-D, HQUSACE, NGB) for distribution to field.
- Received 47 survey responses from 28 installations
- Installations: 12 Active, 8 BRAC, 6 FUDS, 2 NGB

Effect on Site Closeout Time



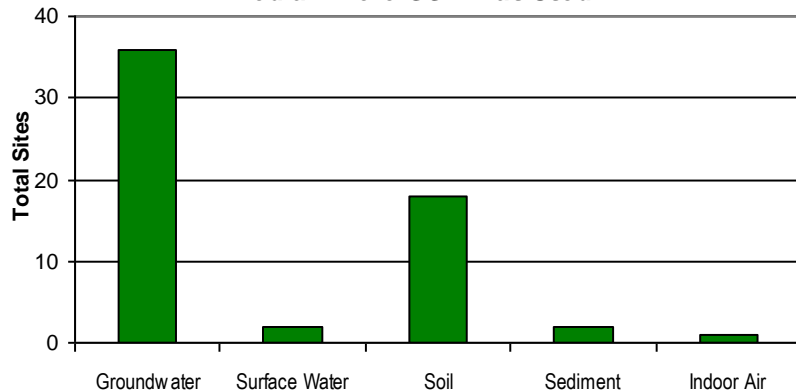
Effect on Project Cost



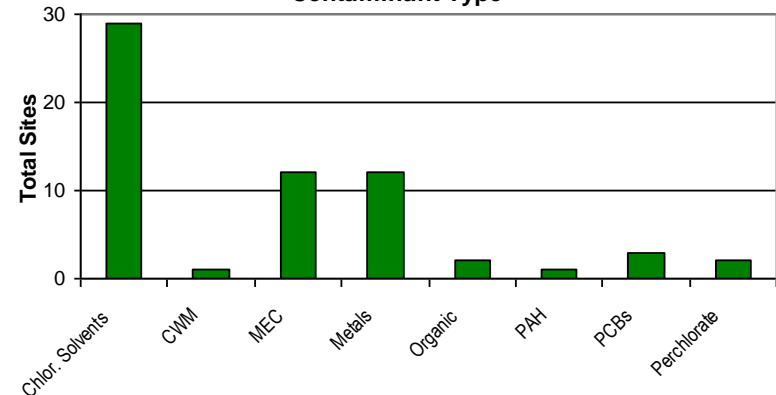


# GSR Remedies and Best Practices

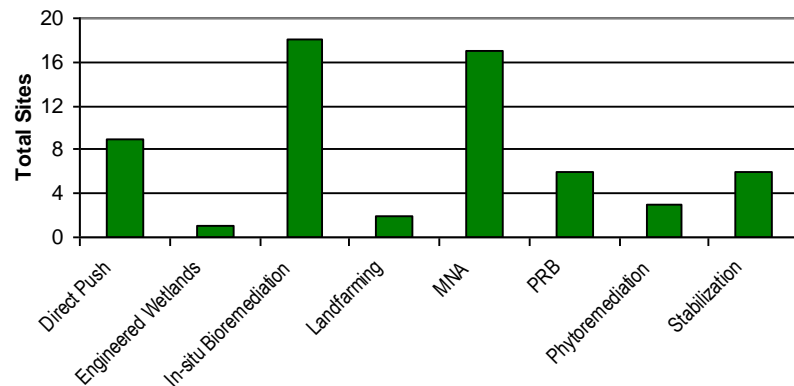
Media Where GSR Was Used



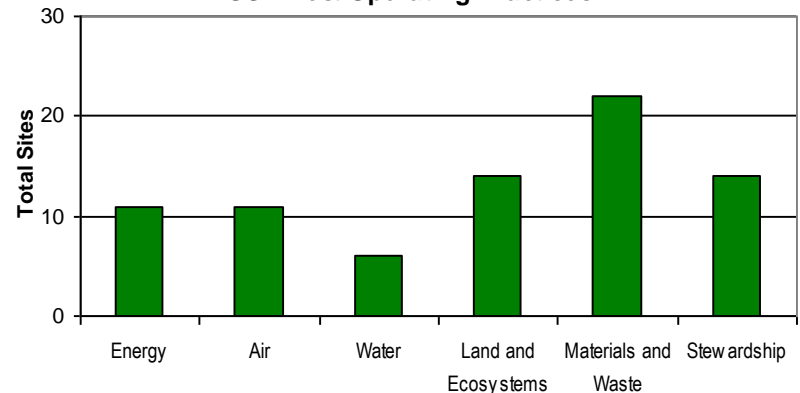
Contaminant Type



GSR Remedy



GSR Best Operating Practices



\* Survey respondents were asked to check all that apply, so the sum within each table may be higher than the total number of surveys received.



# Army Database Analysis

## Active and BRAC Sites

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- Most widely used GSR Remedies include the following:
  - On-Site Treatment
    - In-Situ Soil Treatment (133 sites)
    - Ex Situ Soil Treatment (114 sites)
    - Solidification/Stabilization (58 sites)
    - Soil Washing (9 sites)
  - Treatment that Mimics a Natural Process
    - Natural Attenuation (501 sites)
    - Bioremediation (154 sites)
    - Bioremediation – In Situ Groundwater (126 site)
    - Bioremediation – In Situ (62 sites)
    - Bioventing (41 sites)
    - Passive Treatment Wells (33 sites)
    - Composting (32 sites)
    - Landfarming (12 sites)
    - Alternate Habitat (3 sites)
    - Slurry-Phase Bioremediation (3 sites)

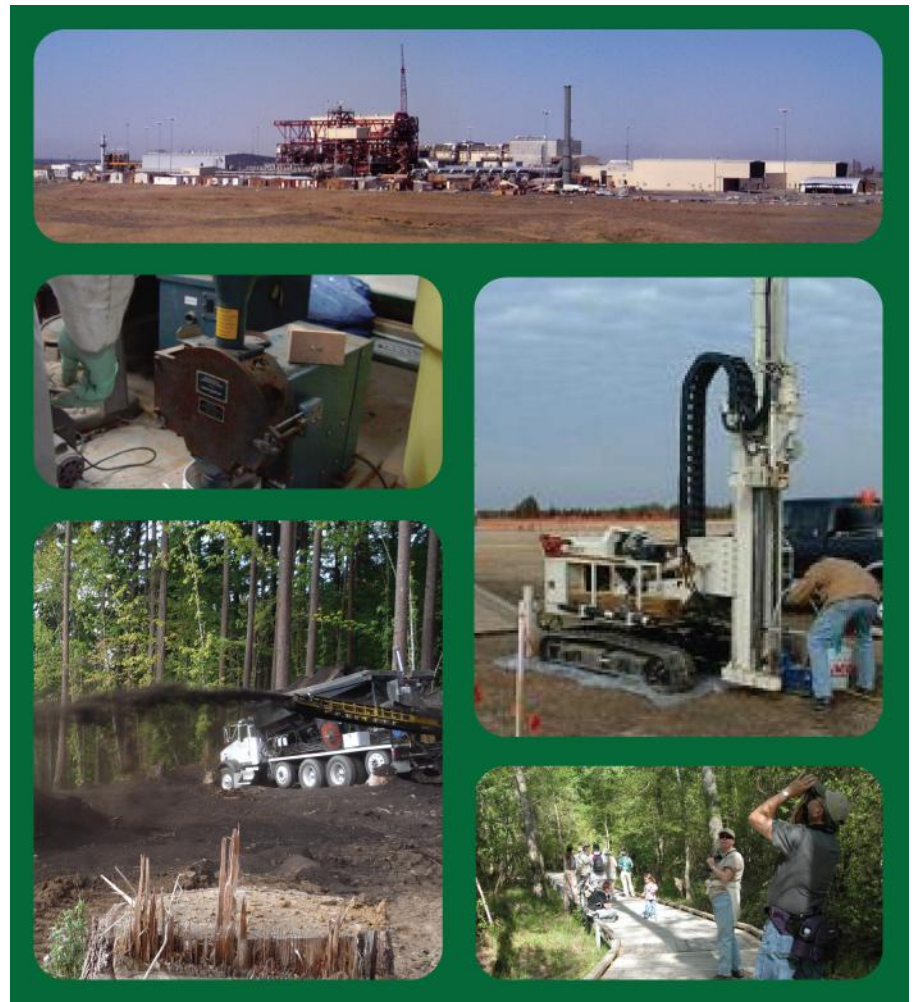
*Because of limited GSR data reported in current data systems, not all sites using green or sustainable remedies are reflected in this list.*





# Case Studies

- Camp Crowder
- Camp Edwards (MMR)
- Camp Withycombe
- Seneca Army Depot
- Volunteer Army Depot





# Camp Crowder

- **Background:** Contaminants in soil and groundwater include chlorinated solvents, petroleum hydrocarbons, and PCBs
- **GSR Approaches:**
  - Soil remediated using landfarming and ex-situ chemical oxidation
    - Landfarming reduced TCE concentrations from > 10,000 ppm to less than 1 ppm
    - Additional treatment by chemical oxidation reduced levels to < 0.3 ppm
  - Groundwater remediated using mobile SVE/DPVE
    - Removed approximately 80 to 190 pounds of predominantly TCE at 3 soil source areas.
    - Used at a fourth site for approximately six months and recovered approximately 30,000 gallons of groundwater and LNAPL
- **Footprint reduction:**
  - Landfarming site reduced transportation needs
  - Mobile SVE equipment eliminated construction of permanent treatment facility



*Area slated for redevelopment at Camp Crowder*



*Abandoned buildings at Camp Crowder*



# Camp Edwards (MMR)

- **Background:** >70,000 cubic yards of soil contaminated and >10 billion gallons of groundwater contaminated with metals, explosives, and perchlorate
- **GSR Approaches:**
  - Base-wide energy optimization and 1.5-MW onsite wind turbine
  - On-site soil treatment with low-temperature thermal desorption
  - Treatment with alkaline hydrolysis using recycled carbon
  - Reusing and recycling of retrieved lead fragments, removed top soil, and use of recycled carbon
  - Use of modular pump and treat system
  - In-situ pilot study using bacteria to treat perchlorate in groundwater
  - Targeted species removal and use of native plants and grass seed for restoration
- **Footprint Reduction:**
  - Reduced energy use and increased use of renewable energy
  - On-site and passive treatment methods
  - Use of recycled materials
  - Reduced construction with mobile treatment systems
  - Minimized impact on wildlife and native species



*The sleek new 1.5 megawatt wind turbine at Camp Edwards, MA, reaches nearly 390 feet up into the sky.*

Photo: Maj. James Sahady, U.S. Army

<http://states.ng.mil/sites/MA/News/Pages/Cape%20Wind%20Turbine%20on%20Line%20for%20Base%20Cleanup.aspx>





# Camp Withycombe

- **Background:** Wetlands and soil were contaminated with a high concentration of metals from small arms training. Received an Environmental Stewardship award from the National Guard.
- **GSR Approaches:**
  - Soil Treatment Process
    - Dry particle separation to remove bullets from soil
    - Wet soil washing process
  - All water involved in the treatment process was reclaimed for reforestation irrigation
  - More than 30,000 tons of soil remediated and 270 tons of lead bullet fragments were reclaimed for recycling
- **Footprint Reduction:**
  - Shorter project lifespan and reduced cost
  - Eliminated 914 pounds of PM, 1.8 million pounds of CO<sub>2</sub>, 141,605 pounds of CO, 36,543 pounds of NO<sub>x</sub>, and 1,672 pounds of SO<sub>x</sub>



*The treatment system processed around 300 tons of soil daily.*



*Bullets were collected in reused one-ton capacity sugar sacks.*



# Seneca Army Depot

- **Background:** 60,000 cubic yards of groundwater contaminated with chlorinated solvents and metals
- **GSR Approaches:**
  - Consisted of three bio-walls of mulch infused with vegetable oil (as a carbon source)
  - Reduced the TCE and chlorinated byproducts through anaerobic processes
- **Footprint Reduction:**
  - Low energy, passive remedy was a cost-effective solution to reduce TCE levels
  - Lower pollutant emissions and fossil fuel use output than standard pump-and-treat technologies



Aerial view of the  
Seneca Army Depot



# Volunteer Army Ammunition Plant

- **Background:** TNT and DNT contamination in soil as high as 10% concentration, impacting both soil and groundwater
- **GSR Approaches:** On-Site Alkaline Hydrolysis
  - Soils were excavated and treated on-site within a contained asphalt-lined former pH control pond
  - Soil treated in 300 yard increments with caustic soda
  - More than 112,000 cubic yards of soil treated using alkaline hydrolysis
  - Total TNT/DNT mass removed is more than 75 tons
  - Average contaminant mass reduction is >93%
- **Footprint Reduction:**
  - No hazardous waste disposal, landfill space, or off-site backfill
  - Reduced transportation/ lowered fossil fuel use
  - Recycled water was used to maintain optimum soil moisture during treatment
  - No risk from breakdown products





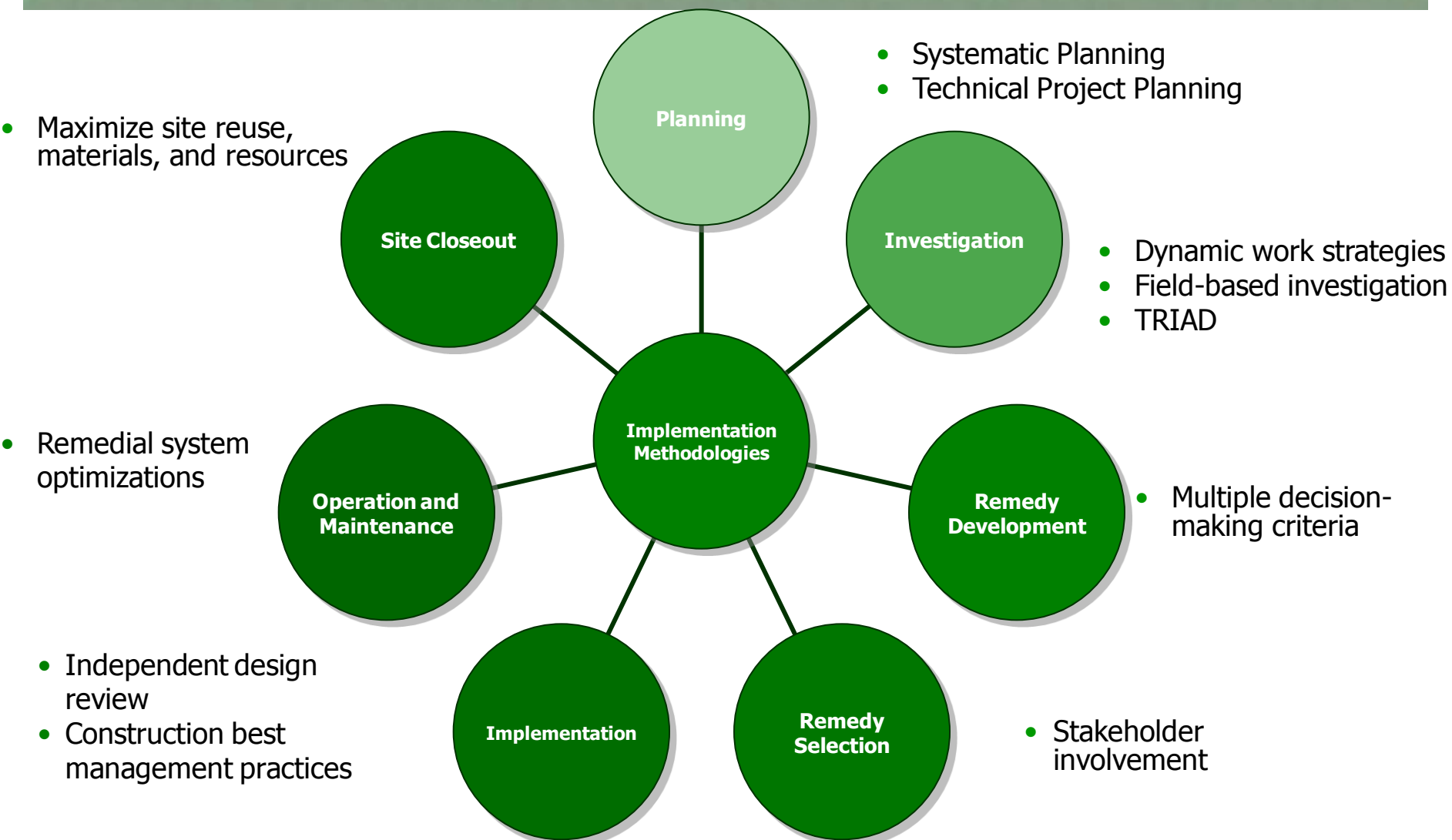


# USACE Decision Framework

- Outlines process for incorporating GSR practices across entire project life cycle
- Applies directly to FUDS sites; can be applied to other sites
- Process differentiates between the statutory CERCLA requirements and optional GSR considerations
- Ways to incorporate the Decision Framework:
  - Methodologies
  - Consideration of GSR Technologies
  - Best Management Practices (BMPs)
  - Compare Remedial Options with Sustainability Evaluation Tools
  - Contract language (including performance-based contracts)
- Interim Decision Framework (March 2010) available at:  
[www.environmental.usace.army.mil/corpguide.htm](http://www.environmental.usace.army.mil/corpguide.htm)



# Recommended Approach: Ways to Include GSR





# Recommended Approach: BMPs and Sustainability Tools

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## BMPs

- Examples: Passive sampling devices, grey water use, native plants for landscaping
- Multiple BMP resources listed in USACE Decision Framework
- BMPs may not always be the most sustainable option

## Sustainability Tools

- Compare remedial options for lowest environmental footprint
- Recommended publicly available tools:
  - Air Force Sustainable Remediation Tool (SRT)
  - Battelle SiteWise™ Sustainable Environmental Remediation (SER) Tool



# Army HQ Next Steps

## Guidance

- Incorporate GSR guidance into the Army DERP manuals
- Evaluate need for specific Army GSR guidance
- Determine applicability of USACE Decision Framework to larger Army environmental remediation program

## Resources and Case Studies

- Create a information exchange through Army Sustainability Web site housing GSR guidance, practices, tools and other available resources
- Develop and test process for GSR consideration and implementation
- Develop and standardize GSR contract language

## Performance Measures

- Continue developing standardized performance measures (metrics)
- Incorporate metrics in revised and new Army databases



# Questions?

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